Fourth National Climate Assessment Vol II

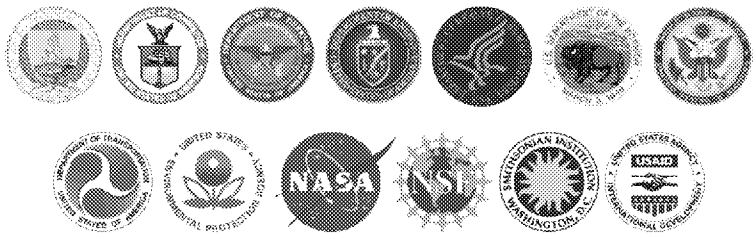
Impacts, Risks, and Adaptation in the United States

Briefing Slides

Mandate and scope

U.S. Global Change Research Program

- USGCRP began as a Presidential initiative in 1989
- Mandated by Congress in the U.S. Global Change Research Act (GCRA) of 1990 "to assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change"
- Overseen by Principals representing the 13 member agencies of the Subcommittee on Global Change Research (SGCR)



National Climate Assessment (NCA) in the GCRA

GCRA (1990), Section 106:

Not less frequently than every 4 years [USGCRP] shall prepare and submit to the President and Congress an assessment which:

- Integrates, evaluates, and interprets the findings of [USGCRP] and discusses the scientific uncertainties associated with such findings
- Analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity
- Analyzes current trends in global change, both human- induced and natural, and projects major trends for the subsequent 25 to 100 years.

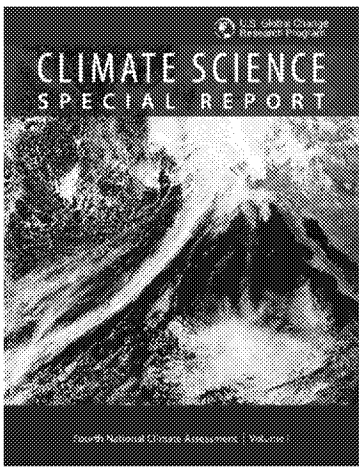
The NCA is a quadrennial report that aims to integrate, evaluate, and interpret the findings of the Program (USGCRP) and analyze the effects and current trends of global change for the subsequent 25 to 100 years.

NCA4: a two-volume effort

Congressional Mandate	Fourth National Climate Assessment (NCA4)	
	Vol I: Climate Science Special Report	Vol II: Impacts, Risks, and Adaptation in the U.S.
Integrates, evaluates, and interprets the findings of the Program (USGCRP) and discusses the scientific uncertainties associated with such findings	✓	✓
Analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity	✓	✓
Analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years.	✓	✓

NCA4 Vol I:
Climate Science Special Report

- Released Nov 3, 2017
- Key advances:
  - Detection and attribution
  - Extreme events (tropical cyclones, tornadoes, atmospheric rivers)
  - Downscaled information (including sea level rise)
  - Potential surprises
  - Climate model weighting
- Summarized in Our Changing Climate chapter of NCA4 Vol II



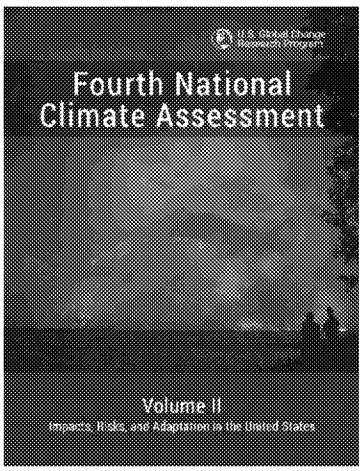
Read and download the report at
science2017.globalchange.gov

U.S. Global Change Research Program

Not only can the CSSR be downloaded and read at science2017.globalchange.gov, but users can access high-resolution graphics for use in their own presentations; dig into the underlying datasets or references; and more.

NCA4 Vol II:
Impacts, Risks, and Adaptation in the U.S.

- Policy relevant, but not policy prescriptive
- Places a strong emphasis on regional information
- Assesses a range of potential impacts, helping decision makers better identify risks that could be avoided or reduced
- Uses case studies to provide additional context and opportunities to showcase community success stories



NCA4 Vol II will be available at nca2018.globalchange.gov

U.S. Global Change Research Program

Not only can the CSSR be downloaded and read at science2017.globalchange.gov, but users can access high-resolution graphics for use in their own presentations; dig into the underlying datasets or references; and more.

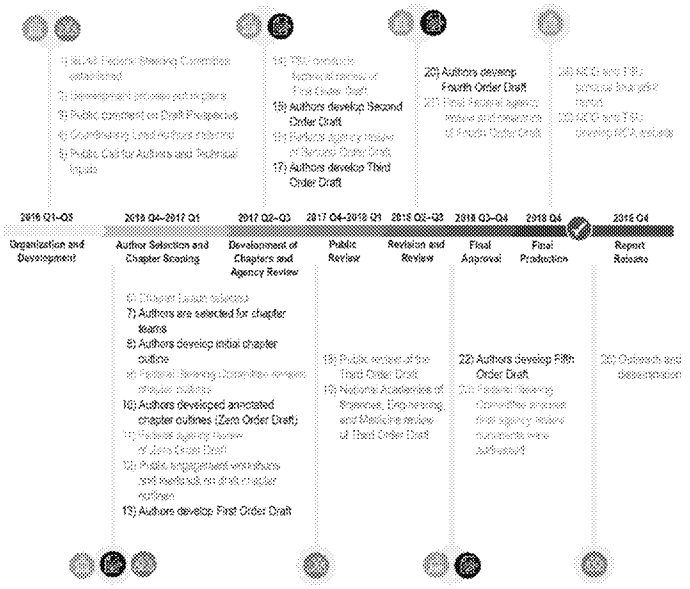
NCA4 Vol II development process

Development timeline

Early 2016	Federal Steering Committee and process guidance established
Summer 2016	Public comment on draft prospectus
Fall 2016	Public call for authors and technical inputs
Dec 2016	**REVIEW:** Steering Committee review of early chapter outlines
Jan 2017	**REVIEW:** SGCR (Interagency) review of annotated outlines
Spring 2017	Stakeholder engagement; First Order Draft developed
Summer 2017	**REVIEW:** SGCR (Interagency) review
Winter 2017	**REVIEW:** Public comment and National Academies of Sciences, Engineering, and Medicine review periods
Spring 2018	**REVIEW:** Final Federal review and clearance
Q3+Q4 2018	Final revisions; production and layout
Nov 2018	***Release***

NCA4 Chronology

- Multiple points of federal review and decision *(orange icons)* throughout the process
- Public engagement *(blue icons)* was a cornerstone of the NCA4 development process
- Authors used these feedback mechanisms to inform the development and execution of their chapters *(black icons)*



Process guidance: overview

- Draw on a wide range of scientific and technical inputs
- Provide multiple opportunities for stakeholder engagement
- Operate on clear science communication principles
- Ensure transparency of process and information
- Employ an extensive review process

Production and oversight

- In consultation with the Subcommittee on Global Change Research, a Federal Steering Committee (or SC; comprising representatives from USGCRP agencies) was responsible for the report's development
- Written by more than 300 Federal and non-Federal authors representing a range of climate-change related expertise
- Coordination, facilitation, and logistical support provided by the USGCRP National Coordination Office
- Production and editorial support provided by a Technical Support Unit at NOAA's National Center for Environmental Information
- Peer reviewed by an *ad hoc* committee of the National Academies of Sciences, Engineering, and Medicine

For additional information on roles/responsibilities, please see supplemental slides 20-22
See next slide for public engagement activities

Author roles

Federal Coordinating Lead Authors (CLAs)

- Oversaw development of a given chapter and worked across chapters to ensure consistency
- Liaised with Chapter Leads

Agency Chapter Leads

- Oversaw National Topic and Response chapters
- Selected National Chapter Leads

National Chapter Leads

- Federal or non-Federal experts
- Organized, directed, and led authorship of individual National Topic or Response chapters in consultation with Fed CLAs
- Established National Topic and Response chapter author teams, with suggestions from the Federal CLAs and the SC

Regional Chapter Leads

- Non-Federal experts selected by the SC from a pool of experts put forward through a public nominations process
- Organized, directed, and led authorship of individual Regional chapters in consultation with Fed CLAs
- Established Regional chapter author teams, with suggestions from the Federal CLAs and the SC

Chapter Authors

- Selected by the Chapter Lead
- Responsible for developing chapter content and responding to comments received

Technical Contributors

- Provided inputs into chapter development but did not directly author sections of NCA4 Vol II
- Selected on an as-needed basis by author teams

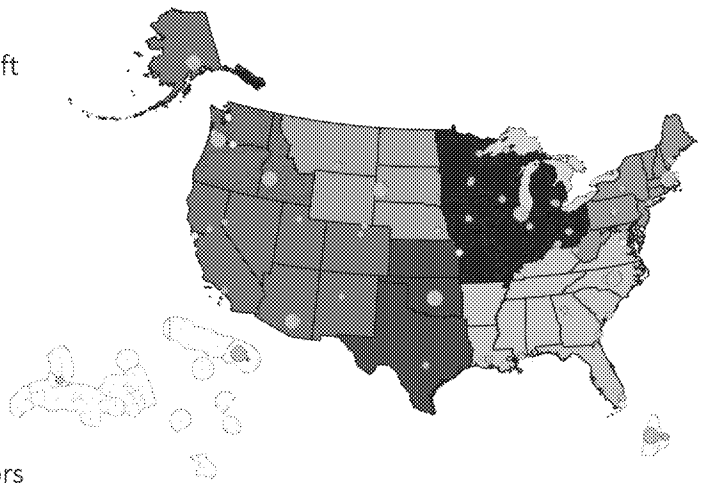
Review Editors

- Selected by the SC from a pool of experts put forward through a public nominations process
- Ensured that authors adequately responded to all comments received during the public and National Academies review periods

For additional information on roles/responsibilities, please see supplemental slides 20-22
See next slide for public engagement activities

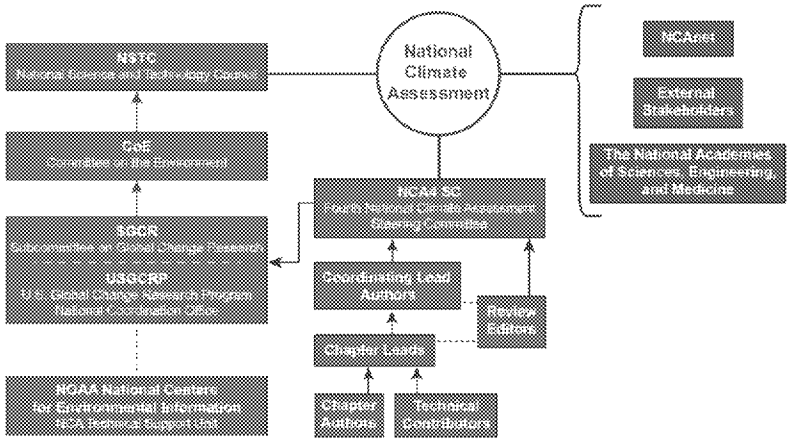
Public participation

- Public feedback on the draft prospectus
- Public call for author nominations
- Public call for technical inputs
- A series of Regional Engagement Workshops (REWs) and sector-specific webinars
- Public call for Review Editors
- A 90-day public review & comment period



Large green dots illustrate the hub locations for the 11 REWs in early 2017. Small green dots indicate satellite locations for those workshops. Small yellow dots show locations of some additional engagement activities, such as presentations or listening sessions at professional society meetings.

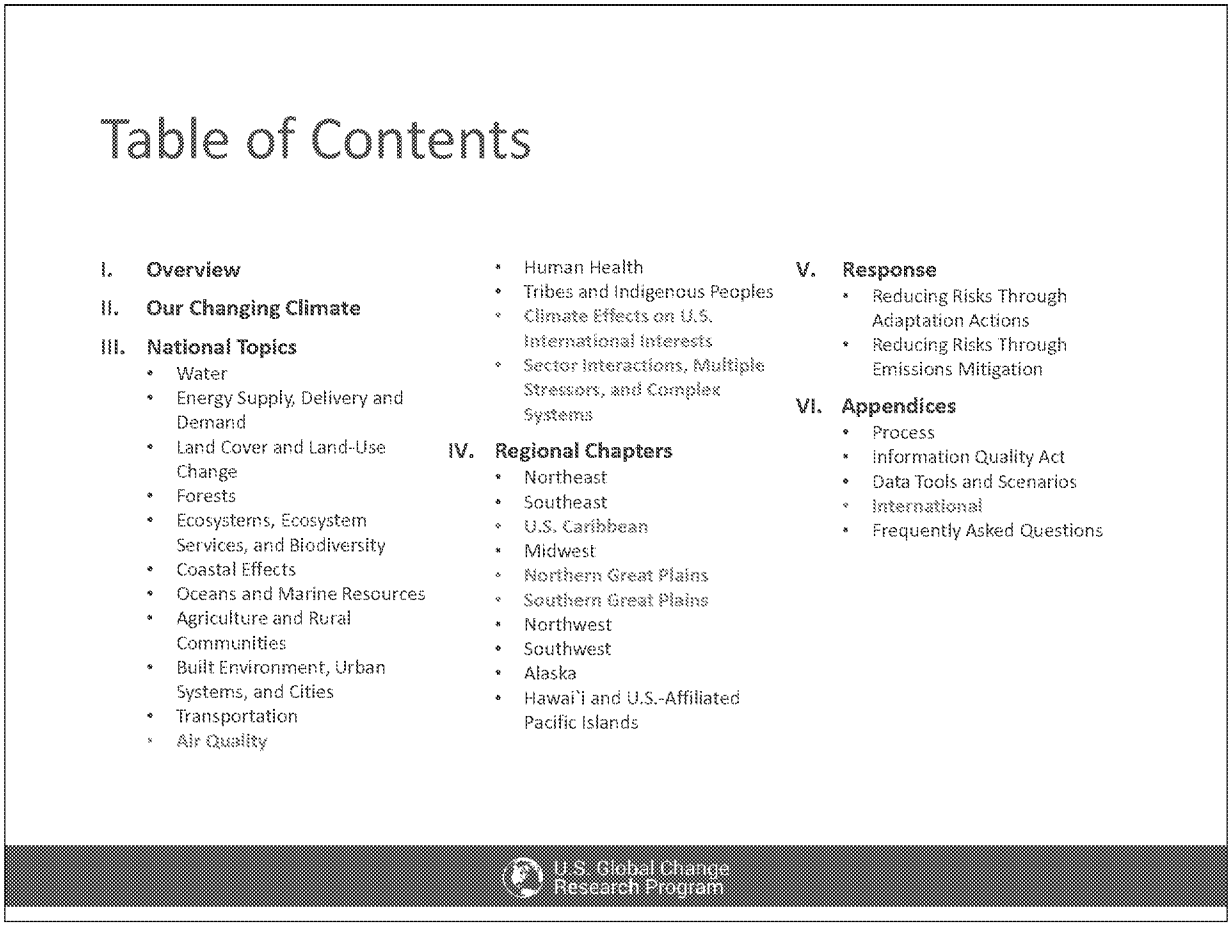
Organization of NCA4 Participants



Three broad categories

1) Federal agencies and offices, including the USGCRP *(blue boxes)*
2) External partners and relevant stakeholders *(purple boxes)*
3) NCA4 contributors, including the Federal Steering Committee and report authors *(orange boxes)*

NCA4 Vol II content development



Multiple rounds of comments have informed our current NCA4 chapter list, and new chapters like air quality and international effects have emerged in response. In addition, the US Caribbean has been split out from the Southeast regional chapter, and the Great Plains have been split into the Northern and Southern Great Plains so as not to have a chapter that spans the Mexican to Canadian borders.

Chapter structure

National Topics and Responses

6-10 pages each

- Executive Summary
- Background/state of the sector
- Regional roll-up
- 2-3 Key Messages
- Traceable Accounts
- References

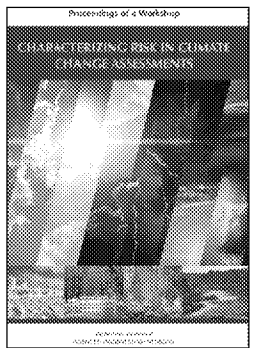
Regions

Approximately 20 pages each

- Executive Summary
- Background
- 4-6 region-specific Key Messages
- Traceable Accounts
- References

Risk Framing in Key Messages

- A **"risk-based framing"** is used to ensure NCA4 focuses on issues of high importance to decision-making and to help with communicating assessment outcomes
- In response to audience needs and with guidance from a workshop of the National Academies, NCA4 Key Messages addressed:
  - ✓ What do stakeholders value/what is at risk in a given sector or region?
  - ✓ What outcomes do we wish to avoid with respect to these valued things?
  - ✓ What do we expect to happen in the absence of adaptive action and/or mitigation?
  - ✓ How bad could things plausibly get/are there important thresholds or tipping points in the unique context of a given region, sector, etc.?



Traceable Accounts

- Describe and document the process and rationale used for reaching conclusions
- Include calibrated confidence level and, where appropriate, likelihood
- Identify areas with limited and/or emerging data or scientific uncertainty
- Provide an opportunity for a more technical discussion than chapter narrative

See supplemental slides for more information on Traceable Accounts and Confidence Levels/Likelihood

Summary Findings

Summary Findings

1. **Communities**
   Climate change creates new risks and exacerbates existing vulnerabilities in communities across the United States, presenting growing challenges to human health and safety, quality of life, and the rate of economic growth.

2. **Economy**
   Without substantial and sustained global mitigation and regional adaptation efforts, climate change is expected to cause growing losses to American infrastructure and property and impede the rate of economic growth over this century.

3. **Interconnected Impacts**
   Climate change affects the natural, built, and social systems we rely on individually and through their connections to one another. These interconnected systems are increasingly vulnerable to cascading impacts that are often difficult to predict, threatening essential services within and beyond the Nation's borders.

Summary Findings (cont.)

4. **Actions to Reduce Risks**
   Communities, governments, and businesses are working to reduce risks from and costs associated with climate change by taking action to lower greenhouse gas emissions and implement adaptation strategies. While mitigation and adaptation efforts have expanded substantially in the last four years, they do not yet approach the scale considered necessary to avoid substantial damages to the economy, environment, and human health over the coming decades.
5. **Water**
   The quality and quantity of water available for use by people and ecosystems across the country are being affected by climate change, increasing risks and costs to agriculture, energy production, industry, recreation, and the environment.
6. **Health**
   Impacts from climate change on extreme weather and climate-related events, air quality, and the transmission of disease through insects and pests, food, and water increasingly threaten the health and well-being of the American people, particularly populations that are already vulnerable.

Summary Findings (cont.)

7. **Indigenous Peoples**
   Climate change increasingly threatens Indigenous communities' livelihoods, economies, health, and cultural identities by disrupting interconnected social, physical, and ecological systems.
8. **Ecosystems and Ecosystem Services**
   Ecosystems and the benefits they provide to society are being altered by climate change, and these impacts are projected to continue. Without substantial and sustained reductions in global greenhouse gas emissions, transformative impacts on some ecosystems will occur; some coral reef and sea ice ecosystems are already experiencing such transformational changes.
9. **Agriculture and Food**
   Rising temperatures, extreme heat, drought, wildfire on rangelands, and heavy downpours are expected to increasingly disrupt agricultural productivity in the United States. Expected increases in challenges to livestock health, declines in crop yields and quality, and changes in extreme events in the United States and abroad threaten rural livelihoods, sustainable food security, and price stability.

Summary Findings (cont.)

10. **Infrastructure**
    Our Nation's aging and deteriorating infrastructure is further stressed by increases in heavy precipitation events, coastal flooding, heat, wildfires, and other extreme events, as well as changes to average precipitation and temperature. Without adaptation, climate change will continue to degrade infrastructure performance over the rest of the century, with the potential for cascading impacts that threaten our economy, national security, essential services, and health and well-being.

11. **Oceans and Coasts**
    Coastal communities and the ecosystems that support them are increasingly threatened by the impacts of climate change. Without significant reductions in global greenhouse gas emissions and regional adaptation measures, many coastal regions will be transformed by the latter part of this century, with impacts affecting other regions and sectors. Even in a future with lower greenhouse gas emissions, many communities are expected to suffer financial impacts as chronic high-tide flooding leads to higher costs and lower property values.

Summary Findings (cont.)

12. Tourism and Recreation

Outdoor recreation, tourist economies, and quality of life are reliant on benefits provided by our natural environment that will be degraded by the impacts of climate change in many ways.

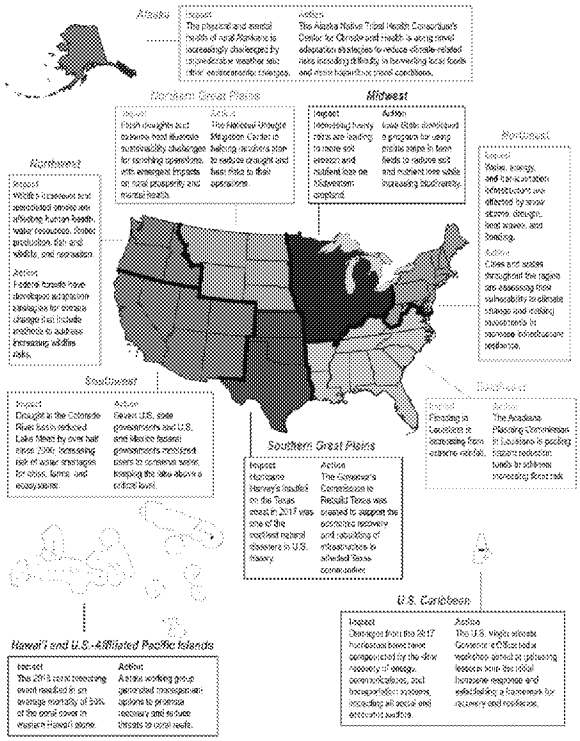
Overview

Introduction: NCA4 Vol II

- Earth's climate is now changing faster than at any point in modern civilization.
- These changes are primarily the result of human activities, the evidence of which is overwhelming and continues to strengthen
- The impacts of climate change are already being felt across the country, and climate-related threats to Americans' physical, social, and economic well-being are rising
- Americans are responding in ways that can bolster resilience and improve livelihoods
- However, neither global efforts to mitigate the causes of climate change nor regional efforts to adapt to the impacts currently approach the scales needed to avoid substantial damages to the U.S. economy, environment, and human health and well-being over the coming decades

Fig. 1.1: Americans Respond to the Impacts of Climate Change

This map shows climate-related impacts that have occurred in each region since the Third National Climate Assessment in 2014 and response actions that are helping the region address related risks and costs. These examples are illustrative; they are not indicative of which impact is most significant in each region or which response action might be most effective. *Source: NCA4 Regional Chapters.*



Our Changing Climate:
Observations, Causes, and Future Change

- Observations collected around the world provide significant, clear, and compelling evidence that global average temperature is much higher, and is rising more rapidly, than anything modern civilization has experienced
- The warming trend observed over the past century can only be explained by the effects that human activities, especially emissions of greenhouse gases, have had on the climate
- Earth's climate will continue to change over this century and beyond. After mid-century, how much the climate changes will depend primarily on global emissions of greenhouse gases and on the response of Earth's climate system to human-induced warming

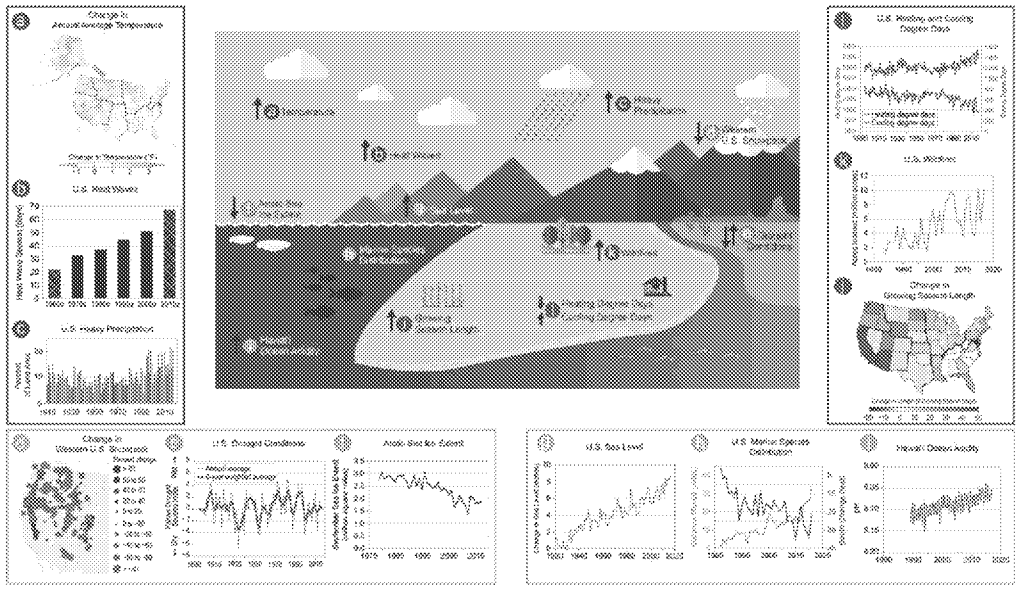
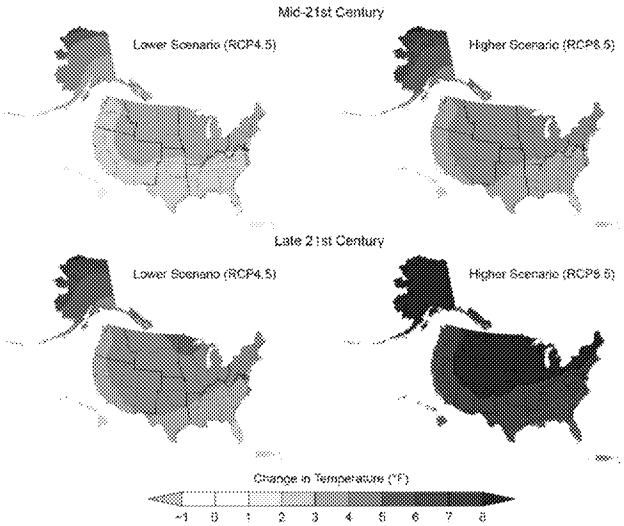


Fig. 1.2: Climate Change Indicators

Long-term observations demonstrate the warming trend in the climate system and the effects of increasing atmospheric greenhouse gas concentrations. This figure shows climate-relevant indicators of change based on data collected across the United States. Upward-pointing arrows indicate an increasing trend; downward-pointing arrows indicate a decreasing trend. Bidirectional arrows (e.g., for drought conditions) indicate a lack of a definitive national trend.

Fig. 1.3: Projected Changes in U.S. Annual Average Temperatures

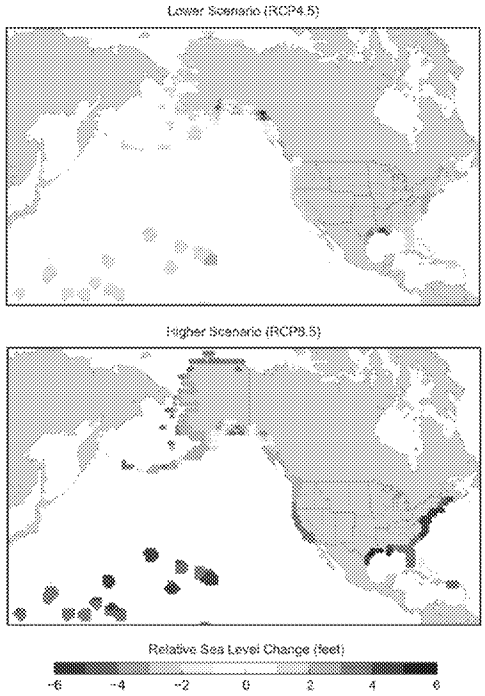
Annual average temperatures across the United States are projected to increase over this century, with greater changes at higher latitudes as compared to lower latitudes, and under a higher scenario (RCP8.5; right) than under a lower one (RCP4.5; left). This figure shows projected differences in annual average temperatures for mid-century (2036–2065; top) and end of century (2071–2100; bottom) relative to the near present (1986–2015)



From Figure 2.4, Ch. 2: Climate (Source: adapted from Vose et al. 2017).

Fig. 1.4: Projected Relative Sea Level Change in the U.S. by 2100

The maps show projections of change in relative sea level by 2100 (as compared to 2000) under lower and higher scenarios. Globally, sea levels will continue to rise from thermal expansion of the ocean and melting of land-based ice masses. Regionally, however, the amount of sea level rise will not be the same everywhere. Where land is sinking (as along the Gulf of Mexico coastline), relative sea level rise will be higher, and where land is rising (as in parts of Alaska), relative sea level rise will be lower. Changes in ocean circulation and gravity effects due to ice melt will also alter the heights of the ocean regionally.



Source: adapted from CSSR, Figure 12.4

Climate Change in the United States: *Current and Future Risks*

- Climate change presents growing challenges to: (1) the economy and our Nation's infrastructure, (2) the natural environment and the services ecosystems provide to society, and (3) human health and quality of life
- Risks posed by climate variability and change vary by region and sector and by the vulnerability of people experiencing impacts
- This report characterizes specific risks across regions and sectors in an effort to help people assess the risks they face, create and implement a response plan, and monitor and evaluate the efficacy of a given action

Economy & Infrastructure

- Many extreme weather and climate-related events are expected to become more frequent and more intense in a warmer world, creating greater risks of infrastructure disruption and failure that can cascade across economic sectors
- Regional economies and industries that depend on natural resources and favorable climate conditions, such as agriculture, tourism, and fisheries, are increasingly vulnerable to impacts driven by climate change
- Some aspects of our economy may see slight improvements in a modestly warmer world. However, the continued warming that is projected to occur without significant reductions in global greenhouse gas emissions is expected to cause substantial net damage to the U.S. economy, especially in the absence of increased adaptation efforts

Fig. 1.5: Wildfire and the Wildland-Urban Interface

Wildfires are increasingly encroaching on American communities, posing threats to lives, critical infrastructure, and property. In October 2017, more than a dozen fires burned through northern California, killing dozens of people and leaving thousands more homeless. Communities distant from the fires were affected by poor air quality as smoke plumes darkened skies and caused the cancellation of school and other activities across the region.

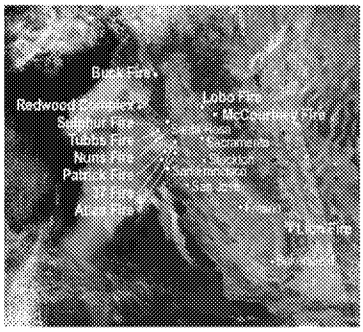


Image credits: (top) NASA; (bottom) Tubbs Fire burn area by Master Sgt. David Loeffler, U.S. Air National Guard.

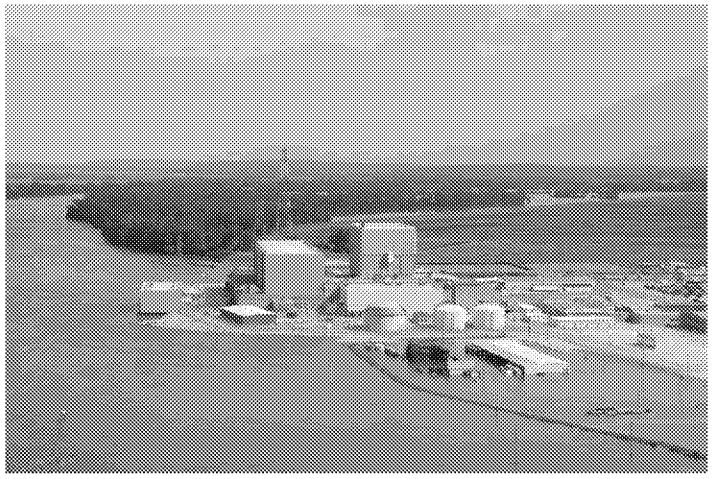
Fig. 1.6: Widespread Impacts from Hurricane Harvey

Hurricane Harvey led to widespread flooding and knocked out power to 300,000 customers in Texas in 2017, with cascading effects on critical infrastructure facilities such as hospitals, water and wastewater treatment plants, and refineries. The photo shows Port Arthur, Texas, on August 31, 2017—six days after Hurricane Harvey made landfall along the Gulf Coast.

From Figure 17.2, Ch. 17: Complex Systems (Photo credit: Staff Sgt. Daniel J. Martinez, U.S. Air National Guard).

Fig. 1.7: Flooding at Fort Calhoun Nuclear Power Plant

Floodwaters from the Missouri River surround the Omaha Public Power District's Fort Calhoun Station, a nuclear power plant just north of Omaha, Nebraska, on June 20, 2011. The flooding was the result of runoff from near-record snowfall totals and record-setting rains in late May and early June. A protective berm holding back the floodwaters from the plant failed, which prompted plant operators to transfer offsite power to onsite emergency diesel generators. Cooling for the reactor temporarily shut down, but spent fuel pools were unaffected.



From Figure 22.5, Ch. 22: N. Great Plains (Photo credit: Harry Weddington, U.S. Army Corps of Engineers).

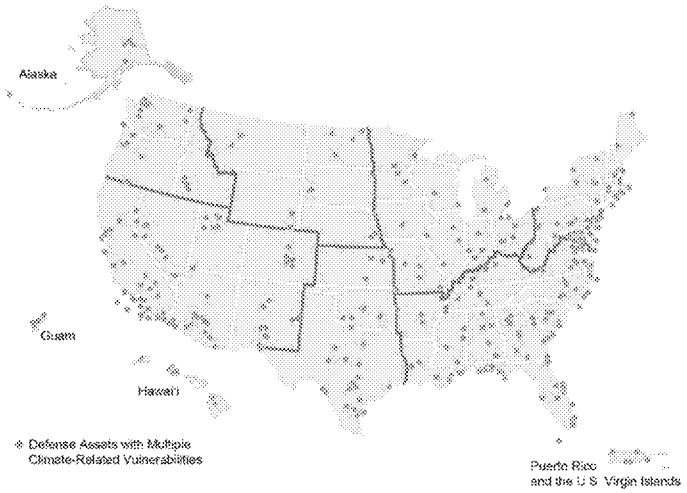
Fig. 1.8: Norfolk Naval Base at Risk from Rising Seas

Low-lying Norfolk, Virginia, houses the world's largest naval base, which supports multiple aircraft carrier groups and is the duty station for thousands of employees. Most of the area around the base lies less than 10 feet above sea level, and local relative sea level is projected to rise between about 2.5 and 11.5 feet by the year 2100 under the Lower and Upper Bound USGCRP sea level rise scenarios, respectively.

Photo credit: Mass Communication Specialist 1st Class Christopher B. Stoltz, U.S. Navy.

Fig. 1.9: Weather and Climate-Related Impacts on U.S. Military Assets

The Department of Defense (DOD) has significant experience in planning for and managing risk and uncertainty. The effects of climate and extreme weather represent additional risks to incorporate into DOD's various planning and risk management processes. To identify installations with vulnerabilities to climate-related impacts, a preliminary Screening Level Vulnerability Assessment Survey (SLVAS) of DOD sites worldwide was conducted in 2015; responses for the United States are shown with orange dots.



Source: adapted from DOD 2018 (http://www.oea.gov/resource/2018-climate-related-risk-dod-infrastructure-initial-vulnerability-assessment-survey-slvas).

Fig. 1.10: Conservation Practices Reduce Impact of Heavy Rains

Increasing heavy rains are leading to more soil erosion and nutrient loss on midwestern cropland. Integrating strips of native prairie vegetation into row crops has been shown to reduce soil and nutrient loss while improving biodiversity. The inset shows a close-up example of a prairie vegetation strip.

From Figure 21.2, Ch. 21: Midwest. (Photo credits: [main photo] Lynn Betts; [inset] Farnaz Kordbacheh).

Natural Environment & Ecosystem Services

- Climate change threatens many benefits that the natural environment provides to society: safe and reliable water supplies, clean air, protection from flooding and erosion, and the use of natural resources for economic, recreational, and subsistence activities
- Valued aspects of regional heritage and quality of life tied to the natural environment, wildlife, and outdoor recreation will change with the climate, and as a result, future generations can expect to experience and interact with natural systems in ways that are much different than today
- Without significant reductions in greenhouse gas emissions, extinctions and transformative impacts on some ecosystems cannot be avoided, with varying impacts on the economic, recreational, and subsistence activities they support

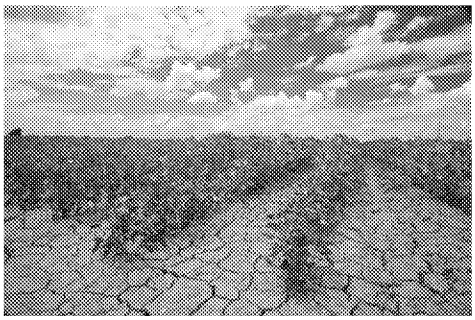


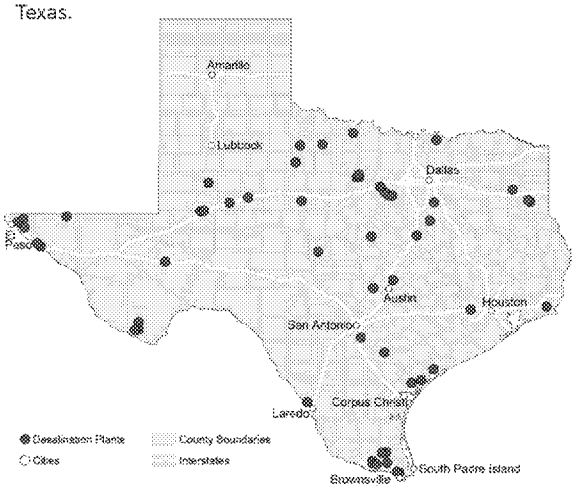
Photo credit: Bob Nichols, USDA.

Fig. 1.11: Impacts of Drought on Texas Agriculture

Soybeans in Texas experience the effects of drought in August 2013. During 2010–2015, a multiyear regional drought severely affected agriculture in the Southern Great Plains. One prominent impact was the reduction of irrigation water released for farmers on the Texas coastal plains.

Fig. 1.12: Desalination Plants Can Reduce Impacts from Drought in Texas

Desalination activities in Texas are important for meeting current and projected water needs for communities, industry, and agriculture. There are currently 44 public water supply desalination plants in Texas.



From Figure 23.8, Ch. 23: S. Great Plains (Source: adapted from Texas Water Development Board 2017).

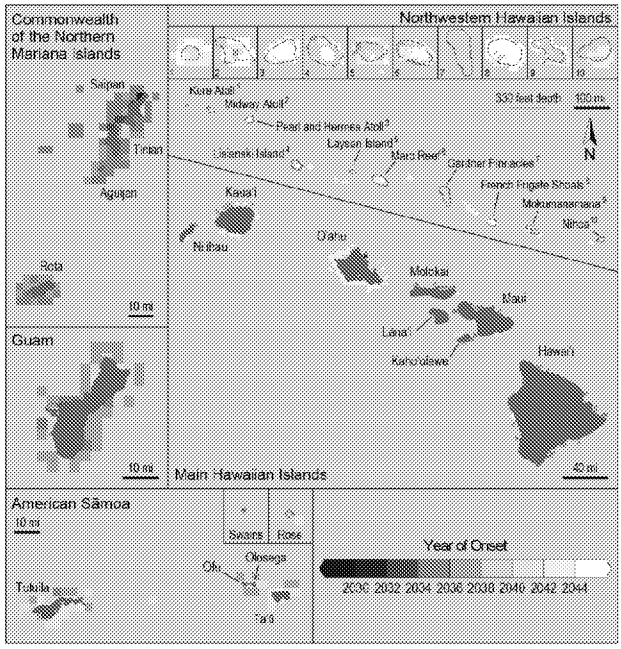
Fig. 1.13: Razor Clamming on the Washington Coast

Razor clamming draws crowds on the coast of Washington State. This popular recreation activity is expected to decline due to ocean acidification, harmful algal blooms, warmer temperatures, and habitat degradation.

From Figure 24.7, Ch. 24: Northwest (Photo courtesy of Vera Trainer, NOAA).

Fig. 1.14: Severe Coral Bleaching Projected for Hawai'i and the U.S.-Affiliated Pacific Islands

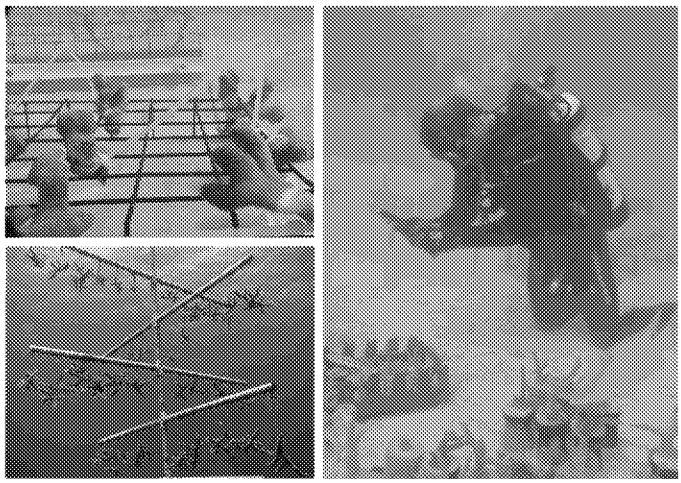
The figure shows the years when severe coral bleaching is projected to occur annually in the Hawai'i and U.S.-Affiliated Pacific Islands region under a higher scenario (RCP8.5). Darker colors indicate earlier projected onset of coral bleaching. Under projected warming of approximately 0.5°F per decade, all nearshore coral reefs in the region will experience annual bleaching before 2050.



From Figure 27.10, Ch. 27: Hawai'i & Pacific Islands (Source: NOAA).

Fig. 1.15: Promoting Coral Reef Recovery

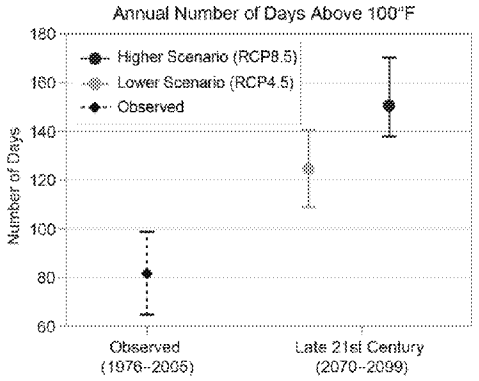
Coral farming is a strategy meant to improve the reef community and ecosystem function, including for fish species. The U.S. Caribbean Islands, Florida, Hawai'i, and the U.S.-Affiliated Pacific Islands face similar threats from coral bleaching and mortality due to warming ocean surface waters and ocean acidification. Degradation of coral reefs negatively affects fisheries and coastal economies. While coral farming may provide some targeted recovery, current knowledge and efforts are not nearly advanced enough to compensate for projected losses from bleaching and acidification.



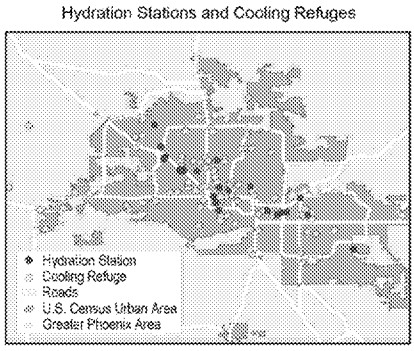
From Figure 20.11, Ch. 20: U.S. Caribbean (Photo credits:[top left] Carlos Pacheco, U.S. Fish and Wildlife Service; [bottom left] NOAA; [right] Florida Fish and Wildlife).

Human Health & Well-Being

- Higher temperatures, increasing air quality risks, more frequent and intense extreme weather and climate-related events, increases in coastal flooding, disruption of ecosystem services, and other changes increasingly threaten the health and well-being of the American people
- Risks are often highest for those that are already vulnerable, including low-income communities, some communities of color, children, and the elderly
- Future climate change is expected to further disrupt many areas of life, exacerbating existing challenges and revealing new risks to health (including mental health) and prosperity



Sources: NOAA NCEI, CICS-NC, and LMI.



Source: adapted from Southwest Cities Heat Refuges (a project by Arizona State University's Resilient Infrastructure Lab), available at http://www.coolme.today/#phoenix. Data provided by Andrew Fraser and Mikhail Chester, Arizona St Univ.

Fig. 1.16: Projected Change in Very Hot Days by 2100 in Phoenix, Arizona

(left) The chart shows the average annual number of days above 100°F in Phoenix, Arizona, for 1976–2005, and projections of the average number of days per year above 100°F through the end of the 21st century under the lower and higher scenarios.

(right) The map shows hydration stations and cooling refuges (cooled indoor locations that provide water and refuge from the heat during the day) in Phoenix in August 2017. Such response measures for high heat events are expected to be needed at greater scales in the coming years if the adverse health effects of more frequent and severe heat waves are to be minimized.

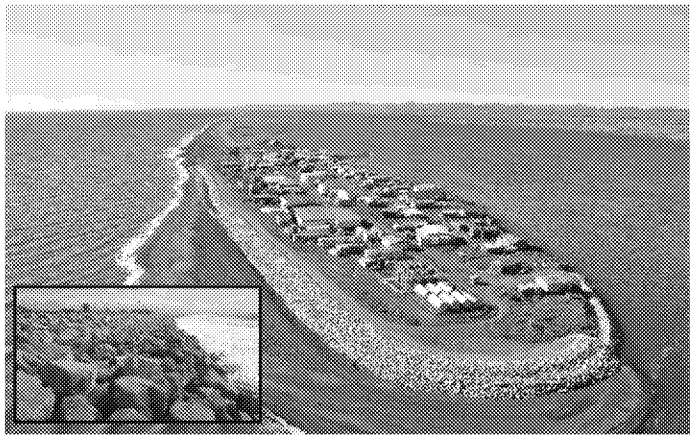
From Figure 15.3, Ch. 15: Tribes (Photo credit: Ronald Stine).

From Figure 15.4, Ch. 15: Tribes (Photo provided by Louisiana Office of Community Development).

Fig. 1.17: Community Relocation—Isle de Jean Charles, Louisiana

(left) A federal grant is being used to relocate the tribal community of Isle de Jean Charles, Louisiana, in response to severe land loss, sea level rise, and coastal flooding.

(right) As part of the resettlement of the tribal community of Isle de Jean Charles, residents are working with the Lowlander Center and the State of Louisiana to finalize a plan that reflects the desires of the community.



From Figure 15.3, Ch. 15: Tribes (Photo credit: ShoreZone. Creative Commons License CC BY 3.0: https://creativecommons.org/licenses/by/3.0/legalcode). The inset shows a close-up of the rock wall in 2011. (Photo credit: U.S. Army Corps of Engineers–Alaska District)

Fig. 1.18: Adaptation Measures in Kivalina, Alaska

A rock revetment was installed in the Alaska Native Village of Kivalina in 2010 to reduce increasing risks from erosion. A new rock revetment wall has a projected lifespan of 15 to 20 years.

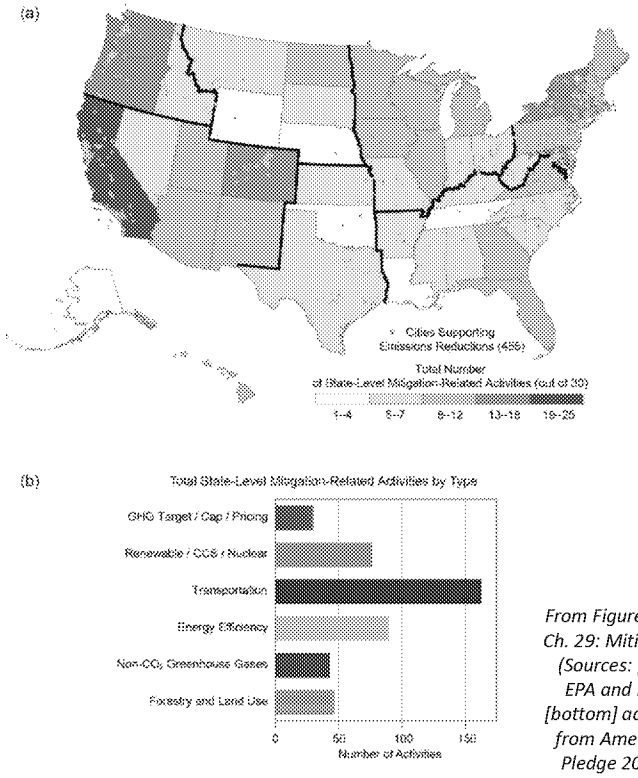
Reducing the Risks of Climate Change

- Many climate change impacts and economic damages in the United States can be substantially reduced through global-scale reductions in greenhouse gas emissions complemented by regional and local adaptation efforts
- Since the Third National Climate Assessment (NCA3) in 2014, a growing number of states, cities, and businesses have pursued or expanded upon initiatives aimed at reducing greenhouse gas emissions, and the scale of adaptation implementation across the country has increased
- However, these efforts do not yet approach the scale needed to avoid substantial damages to the economy, environment, and human health expected over the coming decades

Fig. 1.19: Mitigation-Related Activities at State and Local Levels

(top) The map shows the number of mitigation-related activities at the state level (out of 30 illustrative activities) as well as cities supporting emissions reductions

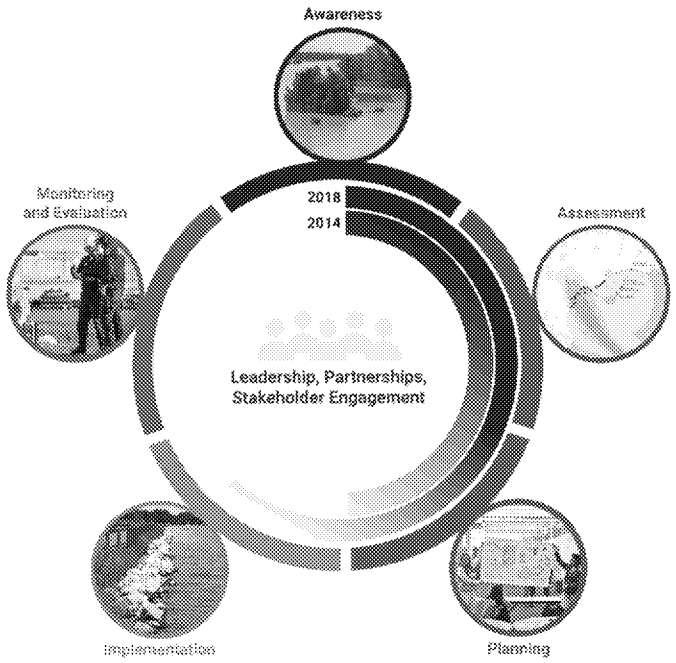
(bottom) The chart depicts the type and number of activities by state. Several territories also have a variety of mitigation-related activities, including American Sāmoa, the Federated States of Micronesia, Guam, Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands.



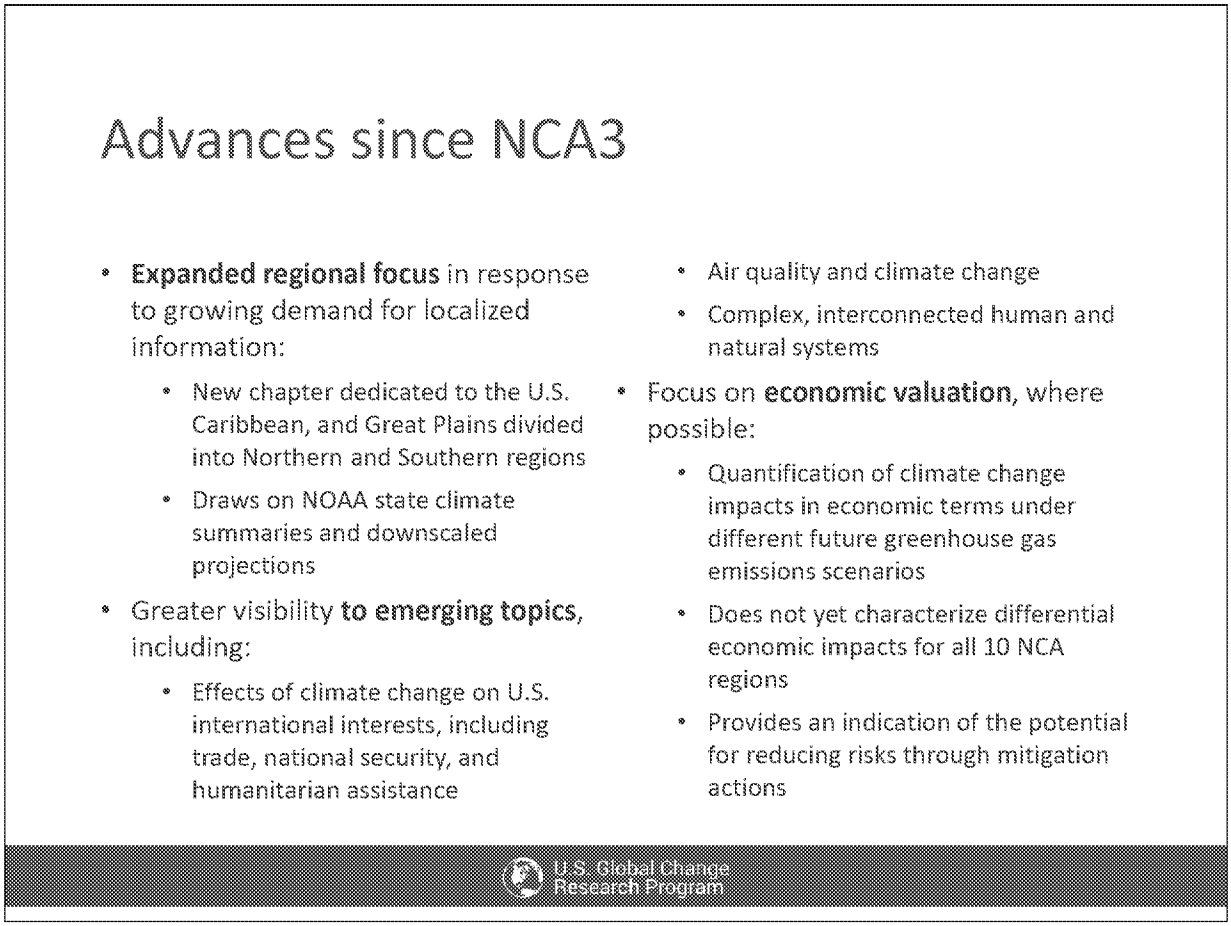
From Figure 29.1, Ch. 29: Mitigation (Sources: [top] EPA and ERT, [bottom] adapted from America's Pledge 2017).

Fig. 1.20: Five Adaptation Stages and Progress

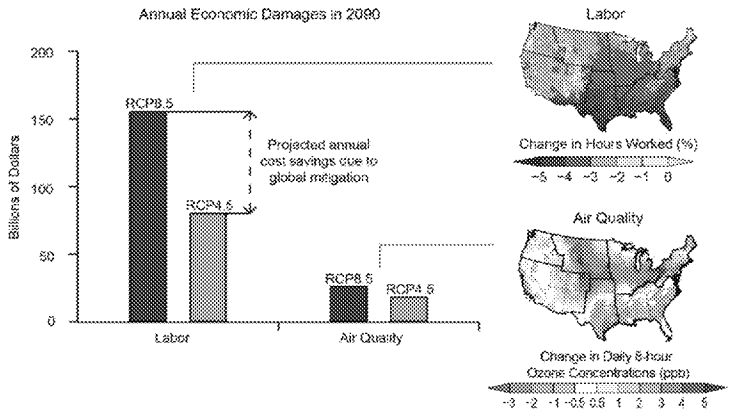
Adaptation entails a continuing risk management process. With this approach, individuals and organizations become aware of and assess risks and vulnerabilities from climate and other drivers of change, take actions to reduce those risks, and learn over time. The gray arced lines compare the current status of implementing this process with the status reported by the Third National Climate Assessment in 2014; darker color indicates more activity.



From Figure 28.1, Ch. 28: Adaptation (Source: adapted from National Research Council, 2010. Used with permission from the National Academies Press, © 2010,National Academy of Sciences. Image credits, clockwise from top: National Weather Service; USGS; Armando Rodriguez, Miami-Dade County; Dr. Neil Berg, MARISA; Bill Ingalls, NASA).



As a part of NCA4's enhanced regional focus, the report includes both information from the NOAA state climate summaries, as well as case studies illustrating some of the impacts and actions communities are facing. The State Climate Summary for Puerto Rico & the USVI is anticipated to be released in the next few months. This will include localized information on climate change indicators including temperature, precipitation, sea level rise.



Source: EPA, 2017. Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment. U.S. Environmental Protection Agency, EPA 430-R-17-001.

Fig. 1.21: New Economic Impact Studies

Annual economic impact estimates are shown for labor and air quality. ***(left)*** National annual damages in 2090 for a higher scenario and lower scenario; the difference between the height of the red and teal bars for a given category represents an estimate of the economic benefit to the U.S. from global mitigation action.

(right) Regional variation in annual impacts projected under the higher scenario in 2090. The map on the top shows the percent change in hours worked in high-risk industries as compared to the period 2003–2007. The map on the bottom is the change in ground-level ozone concentrations compared to the period 1995–2005.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